

Claims

- [c1] 1. A new method and apparatus consisting of a unique ground detector device (ANSI # 64) containing the following five circuits to aid in the location of a ground fault.
- a) ircuitry that will allow the measurement of "offset voltage" which will be used to determine what percentage of the field device has faulted to ground and will indicate which side of the field device is grounded by the voltage polarity.
 - b) ircuitry that will allow a continuous offset voltage reading to be taken by connecting a chart recorder to "test lead connecting jacks" on the ground fault detector.c
 - c) Circuitry that will allow the measurement of "ground fault current".
 - d) Circuitry that will enable the ground fault detector to initiate ground fault current oscillation.
 - e) Circuitry that will enable a common mode voltage (CMV) to be applied to the faulted circuit is utilized to raise the voltage across the actual ground resistance and thereby increase the amount of ground fault current to a detectable value.

[c2] 2. A new method and apparatus as recited in Claim 1 that combines detection and location principals to detect and locate a ground fault on an ungrounded AC or DC system, that can be used as a permanently mounted ground fault detection/location system containing the following additional circuits:

- a) Contacts to operate a local or remote alarm or both.
- b) Staged contact operation that if a hard ground is detected and is continuous, the "hard ground" contacts of the detector would remain closed until the ground fault cleared, the local or remote alarm would not be able to reset the alarm until this occurred.
- c) Momentary contact operation that if a soft ground comes in and stays in, only a momentary signal would be sent to the local or remote alarm that could be reset even if the "soft" ground is continuous (still in).
- d) Re-strike contact operation that if after a specified (adjustable) amount of time, if the soft ground still remains, then the detector/locator initiates another contact operation, verifying that a soft ground still exists.
- e) Momentary/continuous contact operation that if a soft ground becomes a hard ground, then the momentary alarm contacts would now become closed continuously and vise versa.
- f) Adjustable under-voltage or over-voltage condition

monitoring and contacts combining devices 64 (ground fault detection), 27 (undervoltage), and 59 (overvoltage) by being built into one device.

[c3] 3. A new method and apparatus as recited in Claims 1 and 2 to detect ground fault current oscillations, produced by the permanently mounted ground detector/locator device and thus locate the circuit that has faulted to ground, by the use of permanently mounted current transformer modules at each breaker. The modules consist of the following circuits:

a) A current transformer with primary leads wrapped around it in such a fashion that the module can be connected to a load feeder breaker or circuit and the output connected to the load side of the circuit.

b) A signal detection circuit that detects the ground current oscillations on the secondary side of the current transformer that were produced by the ground detector/locator apparatus.

c) An LED indication thus signifying that a ground fault exists in the circuit that the module is monitoring if illuminated.

[c4] 4. A new method and apparatus as recited in Claim 1 that combines detection and location principals to detect and locate a ground fault on an ungrounded AC or DC system that can be used as a portable ground fault de-

tection/location system consisting of the following circuits:

- a) A circuit that will enable the field device to be fed through the portable ground detector/locator by an isolation device, such as an AC-to-AC transformer or DC-to-AC converter for AC systems or a DC-to-DC converter or AC-to-DC converter is used for DC systems or other such converters that can produce an output voltage that matches the normal ungrounded system voltage
- b) A circuit that will enable detecting the ground fault current oscillations, produced by the ground detector device, by the use of a permanently mounted current transformer in the portable ground detector itself.

[c5] 5. A method and an apparatus as recited in Claims 1, 2 and 5 for detecting ground fault current oscillations, produced by the ground detector apparatus, consisting of a hand held signal tracer and comprised of Phase Lock Loop (PLL) circuitry (common to the industry) that will enable it to be wireless and independent of the ground fault detector/locator device.

[c6] 6. A method and an apparatus as recited in Claims 1, 2 and 5 that will allow multiple hand held detectors to be utilized on multiple branch circuits to aid in the location of a faulted circuit to ground.